

Development of an Active Cooling System for a Time-Domain Near-Infrared Optical Tomography (NIROT) Camera Sensor.

Join the cutting-edge research of NIR imaging with BORL – help us save preterm infants' lives



Wanted: master's or bachelor's student

Goal: Turn an engineering challenge into a working prototype: develop an active cooling system to reduce sensor noise and improve TD-NIROT imaging.

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Your engineering skills can make a real difference.

Preterm infants are particularly vulnerable to brain injury when the brain does not receive enough oxygen, potentially leading to lifelong disabilities. At the Biomedical Optics Research Laboratory (BORL), we are developing near-infrared optical tomography (NIROT), a harmless, non-invasive technology designed to image brain oxygenation and help enable timely therapy.

This is where your engineering comes in.

Our current TD-NIROT camera uses a non-cooled sensor that dissipates approximately 1 W of heat. As the sensor temperature rises, the dark count rate increases, adding unwanted noise to the measurements. Your challenge is to solve this real engineering problem by developing an active cooling system based on Peltier (thermoelectric) technology.

This hands-on project lets you take an idea from calculations to working hardware. You will review and improve the existing design, verify the thermal calculations, develop the Peltier driver electronics and control, and ultimately build and test an optimised prototype. Your work will bring together thermal engineering, electronics, control and biomedical optics—with the opportunity to see how your engineering decisions can contribute to technology being developed for neonatal care.

The Biomedical Optics Research Laboratory (BORL), Department of Neonatology, University of Zurich, hosts the project. You will work in an interdisciplinary research environment with expertise in NIRS, NIROT and clinical applications, connecting engineering development with a real biomedical challenge.

Who are we looking for?

We welcome Master's students from electrical engineering, mechanical engineering, physics, biomedical engineering, mechatronics, robotics or related fields. You don't need to be an expert in everything; we are looking for someone who is curious, enjoys solving technical problems, and wants to design, build, and test something that matters.

Keywords: Preterm brain oxygenation · Near-infrared optical tomography (NIROT) · SPAD sensors · Mechanical design · Thermal design · Electronics · PCB design · Peltier cooling · Python/C++

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